Vitis palmata. — Vitis foliis palmatis glabris: lacinis serratoincisis, umbellis racemosis. Habitat in Virginia. Ex horto Parisiensi habui. ♄

Rami purpurascentes, glabri. Folia latitudine & longitudine aequalia, glabra, basi cordata: lacinia lanceolata, attenuata, lateralibus extus dentibus lanceolatis; intermedia ultra quam supra profunde serrata. Stipulae lanceolatae. Racemi pubescentes. Umbellulae approximatae.

Vahl. Symb. Bot. 3. 42. (1794.)

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MISSOURI BOTANICAL GARDEN
GEORGE ENGELMANN PAPERS

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The co-operation of all our botanical associates is solicited in this regard, as a matter of common interest and advantage. For we are all equally concerned in forwarding the progress of the Flora of North America; and we may confidently expect from our botanical associates their sympathy, their forbearance, and their continued aid.

Albinism in Gentiana crinita.—I noticed in the window of one of our Boston city florists a few mornings ago two large bunches of white fringed gentian, and on enquiry learned that they came from Middlesex County, Mass. The petals of the open flowers were creamy white, and the face had a beautiful satiny lustre.

Later my friend Storrow Higginson informed me that he had seen in another florist's window white gentians that were gathered in Brookline, Mass. Mr. Higginson procured a specimen for analysis, but could not find any other difference between it and the normally blue flowers. He commented, however, on the perfect whiteness of the fringe.

I do not now recall any previous mention of albinism in this flower, although it may have been recorded. I have not time at present to look it up, but in any case a record of the present instances may be of interest.—Geo. E. Davenport, *Medford, Mass.*

Trifolium hybridum, L.—On reading, in the October number of the Gazette, Mr. James' note on this species of *Trifolium*, I thought it might be of interest to note, that in Western Canada it is not at all uncommon, and about London I find it plentiful. It occurs not only in old fields and along fence sides, but I have found it in woodlands and along the borders of cedar swamps at quite a little distance from any cultivated ground, showing that here at least it has become pretty firmly fixed.

In a synopsis of the Flora of the Valley of the St. Lawrence and Great Lakes, published by Profs. Macoun and Gibson, in the Canadian Journal for January 1877, it is catalogued as "Introduced. Cultivated fields and along fences. Is very extensively cultivated in the West instead of *T. pratense*."

It is also reported from Eastern Canada in the vicinity of Ottawa, in the proceedings of the Ottawa Field Naturalist's Club for 1879 and '80, and in a letter just to hand from Prof. Macoun, he tells me that he found this species of *Trifolium* growing most luxuriantly at the foot of the Schickshook Mountains, Quebec, in the vicinity of an old camp, thirty miles from any cultivation.—T. J. W. Burgess, M. D., *London, Ontario, Canada.*

A New Polyporus.—Polyporus reniformis, n. sp. Pileus sessile or substipitate, reniform or dimidiate, ascending, concave above and convex below; the surface ferruginous, concentrically sulcate and subzonate; the margin thin and acute; the context ferruginous, soft, floccose, covered with a thin rigid rather elastic

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crust; stratum of tubules occupying about a third of the pileus, ferruginous within, their mouths very small and covered but not closed with a white powder. Spores ferruginous, elliptic-ovoid, .008–.001 mm. long by .006–.007 mm. broad.

Pileus projecting 2–4 in. with a breadth of 3–6 in. and a thickness at the base of $\frac{3}{4}$–$1\frac{1}{2}$ in. gradually thinning out all round to the edge. This species is properly always annual; there are indeed stratified specimens of two or three years growth but in all cases a new stratum of hymenophore is formed for each annual layer of tubules, leaving the preceding growths to crumble and decay.

Growing always about the base of old stumps in an ascending position; I have never found a specimen upon a log. I have met with the species from Dayton, O., down the Miami Valley to Cincinnati and into Kentucky beyond Lexington.

This is a curious member of the group of FOMENTARII of Fries. It has passed heretofore for *P. applanatus*, Pers., but the true *applanatus* grows here abundantly upon stumps and logs and Mr. James, Mr. Meyncke and myself readily distinguish one from the other upon sight. It will be seen that it has affinities also with *P. lucidus*, Leys.—A. P. MORGAN.

MISSOURI BOTANICAL GARDEN
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Lactuca Scariola, L.—This plant, possessing the habit of the Compass Plant in placing its vertical leaves so as to point to the poles, at the time of the publication of Gray's Manual, last edition, was known only at Cambridge, Mass. In a short time it has reached the Mississippi. It is quite abundant at Dayton, Ohio. At Put-in-Bay, Lake Erie it has already become a pest. It is beginning to make its appearance about Detroit, Mich. A few specimens (3–5) were observed by myself at Lincoln in Central Illinois. The above stations I found myself. It is in the list of H. Eggert of St. Louis, Mo. Mr. Bebb has found it at Rockford, Ill. The latter city is so close to Wisconsin that the plant probably grows there or soon will reach that state. A friend, not a botanist, but a good observer, claims to have seen the plant near Richmond, Indiana. The geographical distribution of *Lactuca Scariola*, therefore, west of the Alleghanies, would be *Ohio to Missouri and northward*.—AUG. F. FOERSTE, *Dayton, Ohio*.

The Gazette for 1883.—The attention of our readers is called to the fact that the time for the renewal of subscriptions has come. Every year has brought a large increase to our subscription list and we can assure our patrons that Volume VIII will contain much to interest and instruct. And again we would repeat to our more modest and retiring botanists what we have said so often, that while giving space to somewhat formal papers it is by no means to the exclusion of notes and scraps of information given in the most informal way.

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Peronospora Viticola Schk
& Cent.

in Bolan. Articles of the Bulletin
of the Bussey Institution
Mark 1876
by W G Farlow p. 415

"Curtis, Plants of North Carolina 1867
Enumerates 18 species of
Phoma on the Vitis sp." Farlow

On Bark	Leaves	Fruit
99 Polyporus Viticola Fr.	118 Septoria Vitis BC.	115 Phoma Viticola B & C.
104 Kneiffia candidissima B & C.		
106 Corticium Viticola Fr.	128 Pestalozzia pezizoides Not.	
116 Diplodia Viticola Desm	129 Botrytis Viticola B.C.	
127 Helminthosporium siliquosum B & C.	137 Rhytisma Vitis Schw.	
133. Pezizza peniscillata Schw		
O. villosa Pers		
O. pruinata Schw		
136 Patellaria atrofusca B.C.		
141 Diatrype insitiva Fr.		
D. Viticola Schw.		
142 Valsa Vitis Schw		

I count 17

S. M. DODD, Vice President.
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American Central Insurance Co.
OF ST. LOUIS.

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St. Louis, June 16 1876

Dr Sir. Engelmann
Dear Sir

Please find enclosed Cheque for $64. to cover your bill to date which please acknowledge and return

Yours truly

Chas Branch

BOTANICAL GARDEN
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Rhizomorpha fragilis on roots of pines

Described & figured by Mr Tulasne

1882

See among the Phyllosticteae papers

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George Engelmann Papers

Office Anzeiger des Westens,

St. Louis, July 21 1872.

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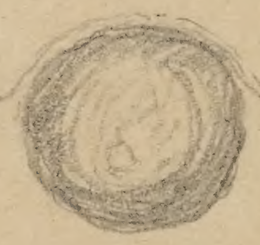
Phyllosticta

May 27 1878

On Vitis, upper side of leaves

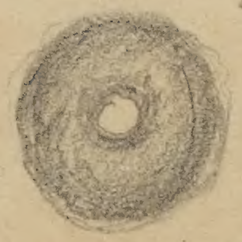
× 150

Worthington section



× 150

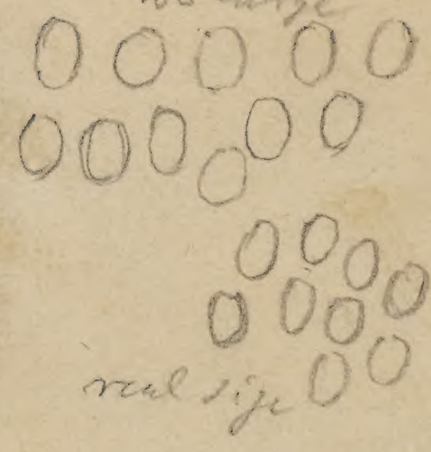
top view



Perithecia

diameter 0.07–0.08 mm

too large



spores × 415

= 0.007 mm long

New fungus, abundant on Vitis in Jefferson County. Yellow spots especially on upper surface of leaf 3–6 mm in diameter, few or many on leaf withering if many. Probably about 1000 spores in each fungus

Compare Septoria Ampelina Cooke p. 444 on Vitis Canada — Georgia Septoria vitis S. C. — Curtis N. Car p. 118

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415 / 200 / 0.007

120 / 12 / 0.07

3 / 24 / 0.08

& 480

4–5 mm / 60

Missouri Botanical Garden
George Engelmann Papers

Leitch & Corlies
WHOLESALE DRUGGISTS
South West Corner Fifth and Market Streets.

01/1

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X 150

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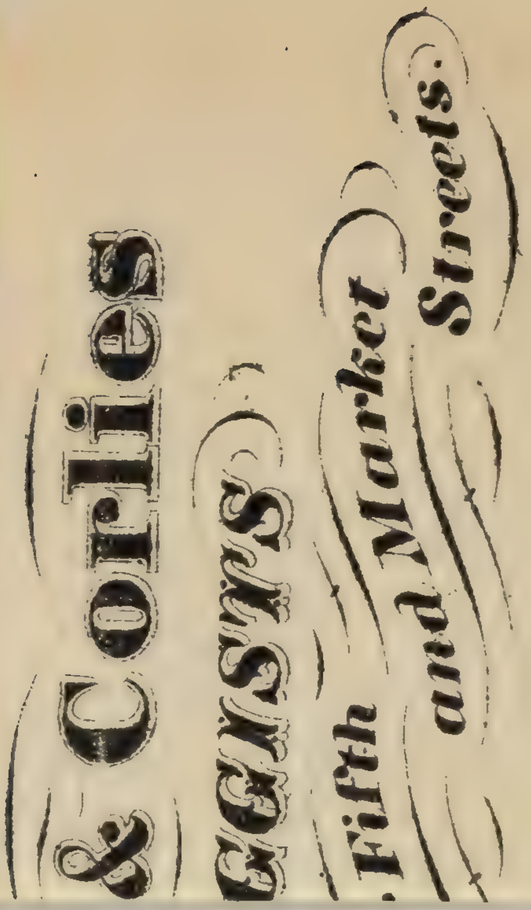

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Leitch & Corlies

DRUGGISTS

South West Corner Fifth and Market Streets.

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GEORGE ENGELMANN FUNDS

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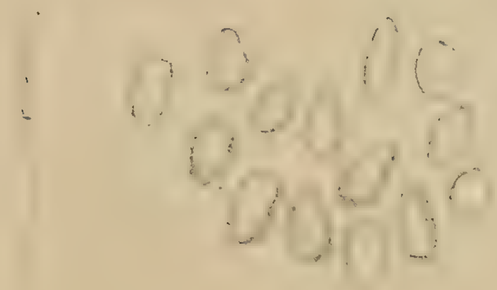
×150

×411



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DRUGGISTS

South West Corner Fifth and Market Streets.

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Pourridié (Rhizomorpha)

of Vries

Hollandsch 1872

see Rhyllosticta papers

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Prof Millardet writes 29 Febr. 1882:

"Plasmopara viticola was first observed at Margate near London 1845 & 47 in an establishment where "probably" also cultivated American grapevines existed. 1848 it was in Versailles, 1854 all over Europe.

The Cryptogam form has not been seen in Europe, but is not rare [?] in America, vide Thomas Taylor Rep. Com. Agricult. for 1871, published 1872

Peronospora viticola

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* see also the same fact in Planchon in Revue des deux Mondes Febr 1874 & ~~1875~~ p. 60

9 Waverly Place
New York July 11/82

MISSOURI BOTANICAL GARDEN
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My dear Sir,

In accordance with Dr. Parry's request, I send you proof of an article for the "Bulletin", in which he has given your diagnosis of the new Yucca detected by him. Will you please make such changes as and return you can? Will you kindly do so as soon as you may desire

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THE PHYLLOXERA.

[THE following extracts are taken from M. Max. Cornu's Report to the authorities at the Cape of Good Hope with reference to the measures to be taken to prevent the introduction of the Vine-louse into the Cape of Good Hope. So far as regards Vines, or parts of Vines, or even plants grown in the vicinity of Vines, there cannot be much difference of opinion as to the prudence of the measures proposed. The absurdity and mischief of the legislative enactments lies in their application to plants other than Vines, and coming from districts where there are no Vines. True it cannot be said there is absolutely no risk even in the introduction of Dutch bulbs or Potatos from a locality scores or hundreds of miles away from any infected locality, but the risk is so small that it is folly, and worse, to inflict an injury on the commerce in these subjects—to give one illustration—because there is a possible risk of importing Phylloxera. Why, in the interests of one class of cultivators, should so much uncalled for injury be done to others with collectively, if not individually, as great or greater right to the consideration of the Governments as the wine growers?]

1. The Phylloxera vastatrix lives only upon the Vine; the insect is the sole cause of the disease of which it is the sign; it is only by acting upon the insect that the disease can be successfully treated.

2. The disease cannot be attributed to degeneration, exhaustion of the soil, bad cultivation, excess of humidity or dryness; the weakest Vines succumb first, but all die in the end.

3. Every Vine that the insect attacks is lost,* unless aided by treatments.

Notwithstanding all that has been said, I am not aware of a single authentic example of a Vine which, having been attacked by the Phylloxera, has recovered without treatment.

4. Means of cultivation and manures that do not actually destroy the Phylloxera have but a passing good effect.

5. The Phylloxera causes special and characteristic swellings upon the roots of the Vines, which are visible when the plants are being dressed; it is the first and most important sign of the disease; the Vine is still luxuriant—this is a deceptive condition.

6. The exhaustion of the plant is only a secondary effect; when this is observed it is getting very late to deal with the disease.

7. During the dry season the swollen rootlets all die at the same time, and the Vine is deprived of its absorbing organs.

The rootlets may form again in the following year; the Phylloxera again settles upon them, and the Vine becomes more and more exhausted.

8. The Phylloxera destroys the rootlets, organs of absorption; this is a characteristic sign, by which Vines that have been attacked by the insect are to be recognised. Suppose a Vine dies, showing every outward symptom of exhaustion; such symptoms are not characteristic. If suffering from exhaustion through some other cause, the Vine will present the same appearance, whilst possessed of its rootlets.

9. If an affected vineyard is replanted, it is not long before the parasite attacks the new Vines.

10. When the temperature of the soil descends below 10° Cent. (50° Fahr.) the Phylloxera winters; the young cease to grow, the adults die.

When the temperature of the soil once more rises above 10° Cent., the Phylloxera awakes, grows, moults, lays, and again multiplies.

11. It is to be concluded from this that in cold countries the winter sleep begins earlier and ends later than in warm ones; this has been superabundantly shown by observation. The insect is much influenced by being exposed to the air, or by the varying temperature of the soil.

In the department of Hérault (Montpellier) the sleep lasts on an average from November 1 to April 15, in that of Charente (Cognac) from October 15 to May 1.

The ravages of the insect increase with the duration of active life, and with the temperature, in an enormous proportion.†

At the Cape of Good Hope the effects of the Phylloxera would be terrible.

Means of Discovering whether a Vine is Diseased through the Phylloxera.

This can only be ascertained by examining the roots.

1. Vines only lately infected (the vegetation is good, or pretty good). Numerous excrescences on the roots; these excrescences disappear during the very hot season.

2. If the date of infection is less recent (feeble vegetation). There are no rootlets.

Besides this the actual presence of the parasite upon the delicate roots should be observed, either with the naked eye, or, better still, with the aid of a lens.

Memorandum on Laws of Protection, and Conclusions, addressed to Captain Charles Mills, C.M.G., Under-Secretary of the Colony of the Cape of Good Hope.

Memorandum on Laws of Protection.—Measures of protection have a scientific basis; it will be useful to call attention to certain facts enabling one to give a conclusive reply to any objection which might be raised.

I am anxious to show that by following, step by step, the natural history of the Phylloxera, and the practical results which are derived therefrom, one is led, step by step, to make laws of gradually increasing stringency.

Prudence demands that every contingency likely to bring about the introduction of the pest should be taken into account, and that the greater rigour should be exercised in proportion as the country is better protected by its geographical position. This was the course we adopted with regard to Algeria.

1. The Phylloxera lives on the leaves of American Vines and on the roots [and leaves] of European Vines; various egg deposits are made on the organs of vegetation.

Conclusion.—It is very dangerous to allow the free importation of Vines with their roots attached, of cuttings, and of leaves coming from countries where the Phylloxera exists—North America, Central America, France, England, Portugal, Switzerland, Germany, Austria, Spain, Italy, &c.

This importation might be forbidden, except under the restriction of full and special guarantees.

2. Roots or parts of roots, when detached from the plant, can nourish the Phylloxera for several months, especially if they are preserved from desiccation. The insect may be kept alive in glass jars from September to May; similar results are observable in its natural state; upon detached roots the Phylloxera lives easily for more than a month at any season.

It is then possible inadvertently to import portions of Vine roots infected with the Phylloxera, in removing plants with their roots attached, and the clod of earth adhering, in cases where such plants have been cultivated in close proximity to Vines.

In order to avoid the introduction of the insect by these means the International Convention of Berne, paragraph 3 (Acts of the Congress, p. 66), provides that plants shall travel packed in a special casing, with their roots divested of earth.

Italy and Spain admit no vegetable products whatever from France, and lay an interdict even upon cut flowers: this is evidently a little too severe.

In any event it is highly necessary that the custom-house officers should exercise the strictest vigilance, and that they should satisfy themselves accurately as to the nature of imported plants.

3. The wingless Phylloxera (Phylloxéras aptères) which lay, are virgin mothers, that is to say, that a single Phylloxera or a single egg, can produce a fertile and very numerous progeny.

This justifies the fears of the wine growers, and the rigorous laws which they desire to have applied as regards the colony.

The eggs offer a stronger resistance than the insects themselves to any unfavourable influences. They are particularly dangerous, whatever may be their nature, but natural history enlightens us as to the precise nature of the danger.

4. The Phylloxera, in its young state, will readily migrate; it can travel comparatively considerable distances whilst in dissociation from the Vine; but it does not seem to be able to live for more than four or five days without nourishment, and in any case it must be protected against desiccation.

The insects, when removed in a living state, without Vine roots, will die at the end of five days; they can, moreover, subsist only upon the Vine.

5. Ordinary eggs take about fifteen days to hatch, at the mean temperature of 15° Cent. (59° Fahr.); this is the limit: a lower temperature retards, a higher temperature accelerates their hatching.

Ordinary eggs, when removed in adhesion (for the Phylloxera does not lay in the soil, but only on the roots of the Vine) will be hatched after about fifteen days; the young will perish five days afterwards.

The most favourable conditions for the introduction of the insect would be as follows:—

A Phylloxera is removed in the soil, say a pregnant mother, which survives for a period of five days; it lays an egg before dying; the egg takes fifteen days to hatch, and the young insect which is produced five days to die. This makes in all twenty-five days. This period would appear to be quite sufficient, particularly with the condition of a slightly elevated temperature.

A quarantine of a few days might be enforced for additional security.

6. The winged Phylloxera produces from four to six eggs of unequal sizes, from which proceeds a special generation of minute Phylloxeras of both sexes; the female lays a single egg.

This single egg exists through the winter without hatching, and indeed only commences to develope at the return of the fine weather. M. Balbiani has named it the winter egg (*œuf d'hiver*).

This egg, which has the faculty of retaining its vitality for so long a period, is particularly to be dreaded.

7. The minute Phylloxeras of both sexes have no digestive organs or sucker; they do not feed, and are therefore not necessarily attached to the Vine; their function is to pair; the female lays her egg on the stem or branches of the Vine, on the surrounding objects, &c.

It is this special egg (winter egg) which is the most to be dreaded, and it is to this egg alone that the introduction of the Phylloxera in packing-cases, straw, &c., could be attributed; this would, however, require confirmation; in fact, I am not aware of any well-authenticated instance of the introduction of the Phylloxera resulting from the transmission of the winter egg.

Such introduction is nevertheless possible from a scientific point of view; propagation takes place in the natural state by this means (from 6000 to 8000 per annum). The accidental removal of the winter egg by human means might clearly take place, it seems somewhat improbable that such removal should be effected by means of articles in general; but the importation of all materials for a vinery—of stakes, supports, boughs, and remnants from vineyards—should be strictly forbidden.

Is the winter egg to be dreaded through the importation of fruits and seeds of any kind, of Grape stones, or of Grapes divested of leaves? The International Convention of Berne concluded that it was not, but more vigour should be exercised in a land free from the scourge, and removed from its seat, than in European countries.

Two points were particularly mentioned by Captain Mills, Under-Secretary of the Cape Colony.

a. Cereals are clearly to be placed in the category of seeds, fruits, &c. The introduction of the Phylloxera in its natural state is impossible; that of the winter egg is not very probable, the egg would no doubt be destroyed in the many handlings incident to ship transport.

It cannot be said that there is absolutely no danger, but it would require a concatenation of circumstances which it is difficult to imagine to bring about the misfortune of the insects introduction.

b. Potatos* cannot carry portions of roots with them unless gross blunders are made, as they are always divested of earth. They might possibly carry some stray Phylloxeras, as well as their eggs.

Neither the eggs nor the insects will be able to give birth to any progeny if an interval of about thirty days takes place between the time at which the crops are gathered (or, better still, the time at which they are shipped) and that of their arrival.

The Phylloxera Commission (of France) several years ago considered the question of the importation of Potatos into Algeria; notwithstanding serious apprehensions, the Commission sanctioned this impor-

* This is applicable only to non-resisting Vines, that is to say plants coming from European stocks, Vitis vinifera, known in France under the names of Chasselas, Muscat, &c., and in England under corresponding names, analogous or different.

† Some idea of the increase may be gathered as follows:—Say one laying a month takes place, and that there are 100 eggs for each laying, the progeny resulting from a single egg would increase according to the powers of 100; the increase would be very great for the last few months. 100, 10,000, 1,000,000, &c.

* The Colorado Beetle (Doryphora) is to be feared, as is well known; I have no concern with it here.

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tation, in the fear of depriving our colony of a most important resource in years of distress, but they reported in favour of disallowing the importation of living plants.

On Saturday, June 5, 1880, before the representatives of the horticultural societies of France, the Commission maintained its full concurrence with the Protection Proclamation of Algeria (Proclamation of the Governor-General).

General Conclusions.

It cannot be denied that it would be dangerous to authorise the importation of cereals, but this danger, which is theoretically shown to exist, is comparatively slight, and might well be overlooked when the difficulties likely to result from absolute prohibition are considered.

The importation of Potatos, though completely divested of earth, presents a more serious difficulty; but the length of the voyage must diminish the chances of introducing the Phylloxera, if an interval of thirty days at least takes place between the time at which the crops are gathered (or shipped) and that at which they are landed.

Nevertheless, the immediate proximity of these products to vineyards, and especially their importation, are always to be dreaded.

As a rule fruits and seeds might be admitted, but the introduction of all parts of the Vine, of everything connected with its cultivation, of plants grown in its neighbourhood, &c., should be strictly prohibited.

It would even be well, if such a course were possible, to imitate the example set by Algeria, and to forbid the introduction of all vegetable products whatever, with the exception of those which are absolutely required for consumption.

It is on the presumption that the Phylloxera does not exist at the Cape of Good Hope that these stringent measures are recommended.

There is an essential distinction to be established between the districts in which the Phylloxera exists and those where it does not. The above remarks are applicable to districts in which it is supposed or suspected that the Phylloxera exists.

Captain Mills seemed disposed to consider that such was the case with regard to all the wine districts.

Maxime Cornu, Paris, June 9.

DISEASE IN PLANTS.

(*Continued from p.* 600.)

WOUNDS, &c.—Perhaps the strongest contrasts may be seen in the wounds or strippings of trees that go down to the layers of wood; or, in what will follow the amputation of a branch from a tree and of a limb from a man. You may see in front of St. Catherine's College some Elms from which branches were cut yesterday, and not far off, at Addenbrooke's Hospital, I dare say you may see patients from whom parts of limbs have been amputated; and, if the stumps have been treated after the manner advised by our distinguished President, they will have been left to be repaired by Nature as truly as are the stumps of the branches of the Elms. The stumps in the hospital have been cut in better shape for healing; but those in the garden have the advantage of more perfect rest, and, in whatever shape they might have been cut, the result would have been the same. Now, it is most probable, nearly sure, that the human stumps will be healed in a few weeks. But it will need a very long life to see the healing of any stump of the same size on the trees. The wood cut across will die, and its necrosis will never be repaired; rotting, like a caries, may extend from it into the trunk, but it will not be repaired. Year after year the annually formed rings of new wood and bark will overlap the borders of the wound; each year they will grow thicker and will converge, and at last after many years they may, perhaps, meet and coalesce and cover-in the wounded surface; but they will not unite with it, there will always be a cavity over the dead wood: a stump so ill-healed as would be a shame to any hospital. I must not imply that there are no better healings after amputations in trees than you may see in Elms; some trees heal better, as do Beeches and Planes; but I think it may be said generally that the stump of any branch will need more years for its healing than the stump of a limb of the same size will need of weeks; and that, in the end, the work of the weeks will be far more reparative than that of the years. And in this reckoning I would include not only the limbs that have been surgically cared for, but those that have been violently crushed or mutilated in animals left to themselves.

This slowness and defect of repair are observed in other things besides the healing of wounds. Dead portions of leaves, or of wood, or other structures, are not cast-off unless by external force.* We have borrowed the word "exfoliation" to tell of the separation of dead bone; but, as I have said, it is only living leaves that can exfoliate. Dead pieces of young wood remain where they were killed, as they often are, without external wounds, by hailstones † or any accidental blows. The structures adjoining them may become hard or corky, but they do not separate from them, there are none of the reparative changes which are seen in even a "quiet necrosis." Similarly you may often see dead tips of leaves perfectly defined from the living parts by colour and by texture, yet without any groove or other sign of process of separation, the dead and the living epidermis remaining still continuous. And as to recovery from diseases I believe it may be summed up in saying that no vegetable structure altered by disease ever reverts to its original healthy state. ‡

Now let me commend to you this subject of the repair of injuries in plants, not only for illustrations of our pathology, but as a part of the study of what may be called the philosophy of healing. They heal very slowly and imperfectly; they may need many years for the healing of small injuries—eight or nine years for a frost-crack in a young branch § — yet they do heal; the intention, as Hunter would have called it, is not given up. Let me relate one case. ‖ A Fir tree, fifty years old, had a large piece of bark stripped from its trunk. The wound extended round nearly a fourth of the circumference of the trunk, and laid bare the wood. It was not dressed or guarded; the outer layer of the exposed wood died as usual, and then every year the successive annular growths of new wood and bark extended a little further over the bared place. In 150 years these growths met and coalesced, and the wound was covered in. When the tree was felled and cut through at the injured part, where there was still a deeply depressed scar, the concentric rings of wood proved the growth of fifty years before, and 150 after, the injury, and even now the healing was not complete; there was still a cavity between the old wood and the new. The healing was not such as we should call good in any similar case in an animal. Still, there was healing; the "intention" was maintained for a century and a half.

Surely, in our familiarity with the processes of repair we overlook their wonder; the wonder that there should be in anything an inherent power of repairing the consequences of accident; that, for instance, in any one of us, after living for many years, with only those timely regular changes, the methods of which we have inherited from our ancestors, an accident, some quite unlikely event, such as may never have happened to an ancestor, such as no conceivable process of selection or of inheritance can have prepared us for, some mere chance as we must call it, should bring out an increased power and a new method of organising structures exactly adapted to the repair of the consequences of that chance. And let me remind you that this power of repair is not a property of living things alone—it is evident in crystals.

It may seem unreasonable to say that we may study principles of elemental pathology in the apathetic inorganic world, or in things that we call dead. But certainly we may study them in crystals. The experiments of Jordan, which I repeated many years ago, and related in lectures at the College of Surgeons * have been extended by Pasteur,† Karl von Hauer,‡ and others, and this chief fact has been abundantly proved—that if a portion of a crystal be broken off, or filed or dissolved away, and if then the mutilated crystal be replaced in a solution of the same salt or of an isomorphous one, the lost part will be replaced, the damaged form will be repaired. In this process of repair the whole crystal will be enlarged, new crystalline matter will be formed on every surface, but the quantity formed on the injured part will be greater than that formed on any other part, and repair will be more active than mere growth till the proper form of the crystal is regained. Then, when the repair is complete, growth alone will go on and each part of the crystal, if it remain in the same solution, will increase in due proportion with the rest.

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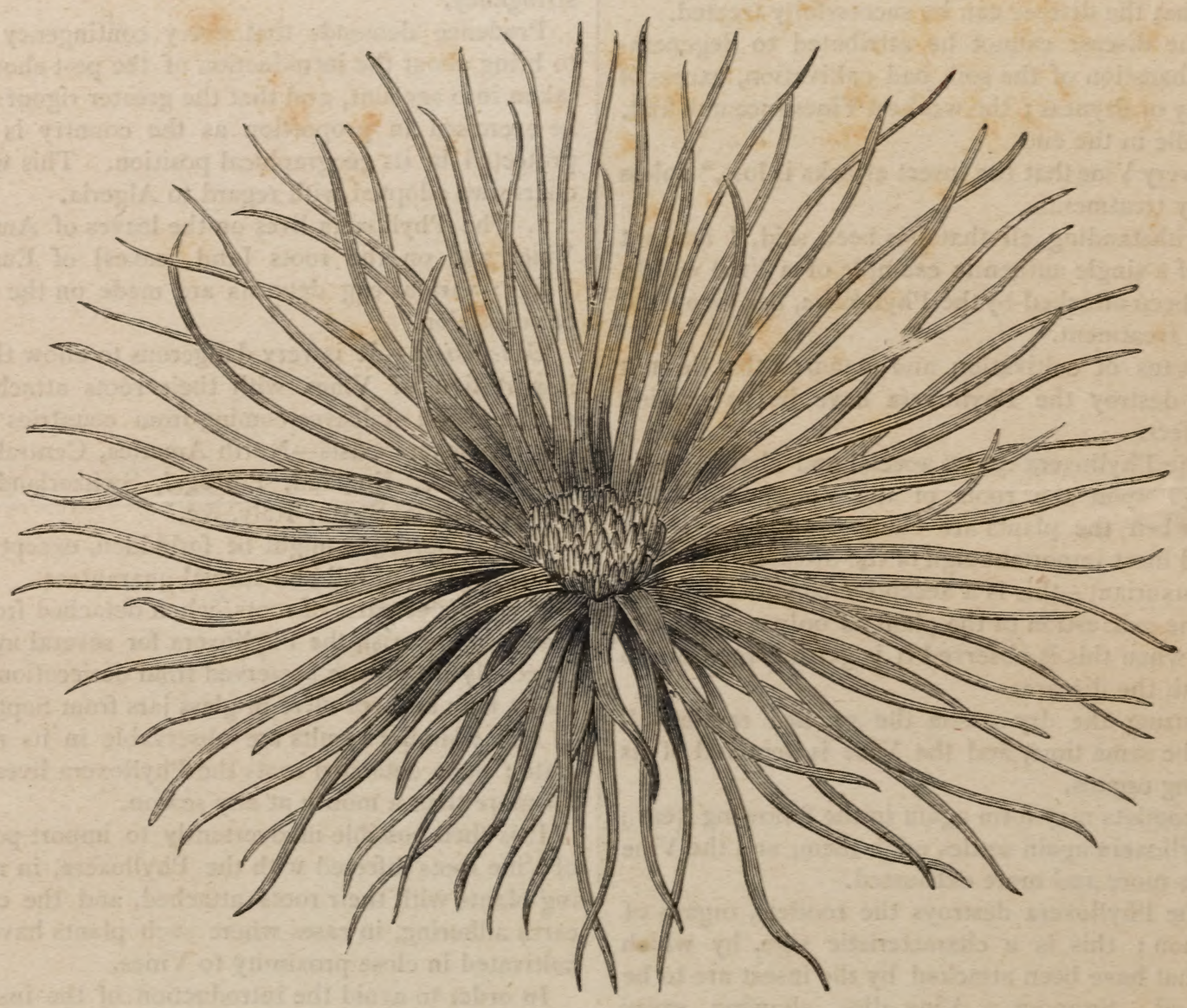

FIG. 116.—JAPANESE CHRYSANTHEMUM. (SEE P. 628.)

* A partial exception must be made for the tips of the fibres and vessels divided in some cuttings. See Arloing, "Sur le Bouturage des Cactées," *Ann. des Sc. Naturelles: Botanique*, B. iv., p. 24, 1876.

† Goethe, *Ueber den Krebs der Apfelbaume*, 1872, p. 2.

‡ "It is confessed that diseases in the vegetable kingdom, when once established, are, for the most part, uncontrollable." Berkeley, *Gardeners' Chronicle*, Jan. 21, 1854, p. 37.

§ Goethe *loc. cit.*, figs. 3 and 4.

‖ From Ratzburg, *Die Waldverderbniss.*, vol. i., p. 98, pl. 21-22, and 31*a*-32.

* *Lectures on Surgical Pathology*, p. 118, ed. 3.

† *Ann. de Chimie et de Physique*, t. xlix., 1857, p. 6.

‡ *Sitzungsbericht der K. Akad. der Wissenschaften*, B. xxxix; Wien, 1868, p. 611.

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